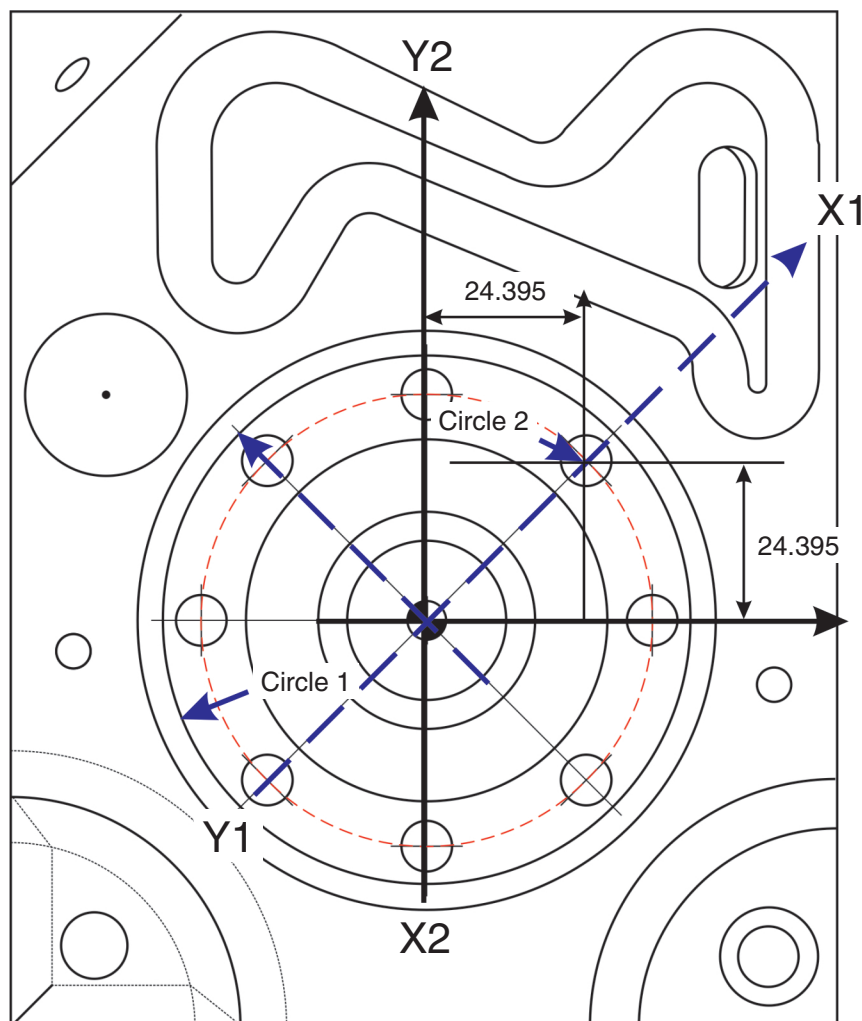


Part alignment - plane and two circles (one offset) (non-CAD)



X1 - Y1: Coordinate system through the two holes.

X2 - Y2: Coordinate system corrected via rotation.

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Part alignment - plane and two circles (one offset) (non-CAD)

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1 Part alignment - plane and two circles (one offset) (non-CAD)

1.1 Tutorial pre-requisites

- The student should be familiar with the 'Principles of part alignment'
- The student should have covered 'Part alignment - plane, line and point' and 'Part alignment - plane and two circles'

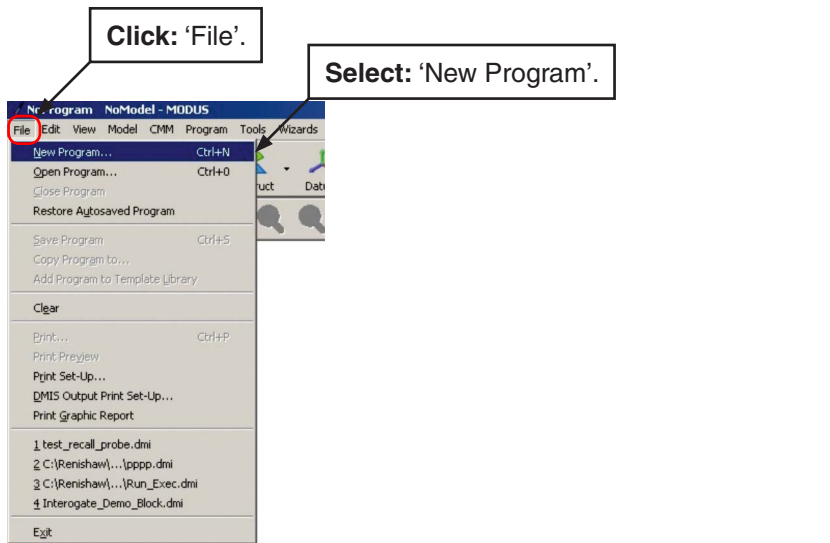
1.2 Tutorial objectives

- Further exposure to feature measurement and constructions
- Introduction to datum manipulation - rules and practical application

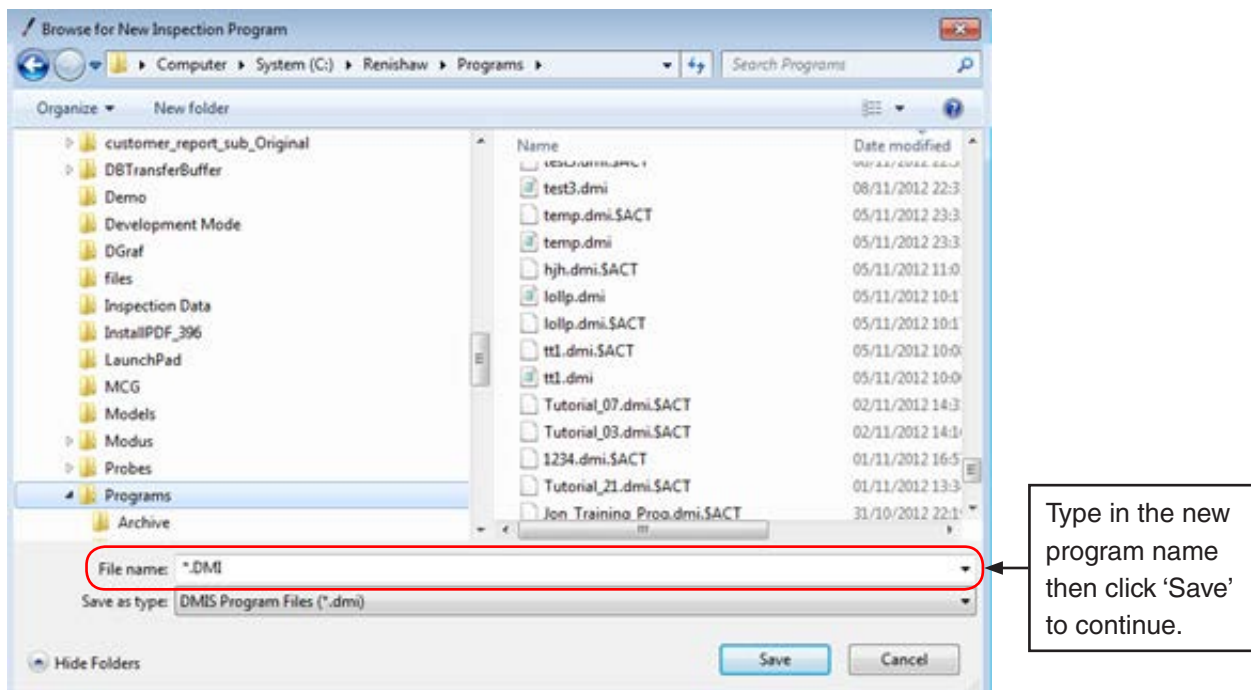
2 Introduction

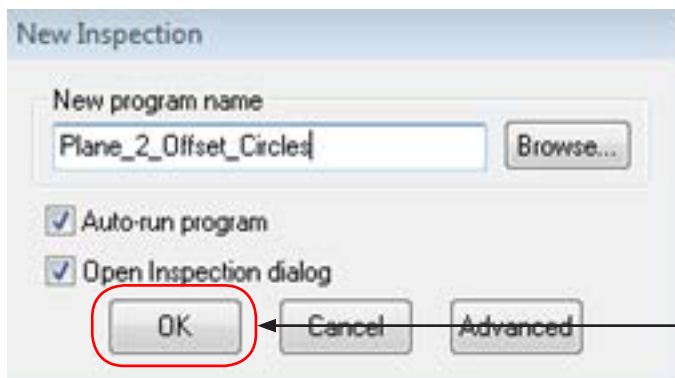
This tutorial introduces the student to a practical scenario where drawing datum requirements cannot be directly transposed from feature definitions, i.e. boxed ("reference" or "basic") dimensions are applied.

3 Create a new program

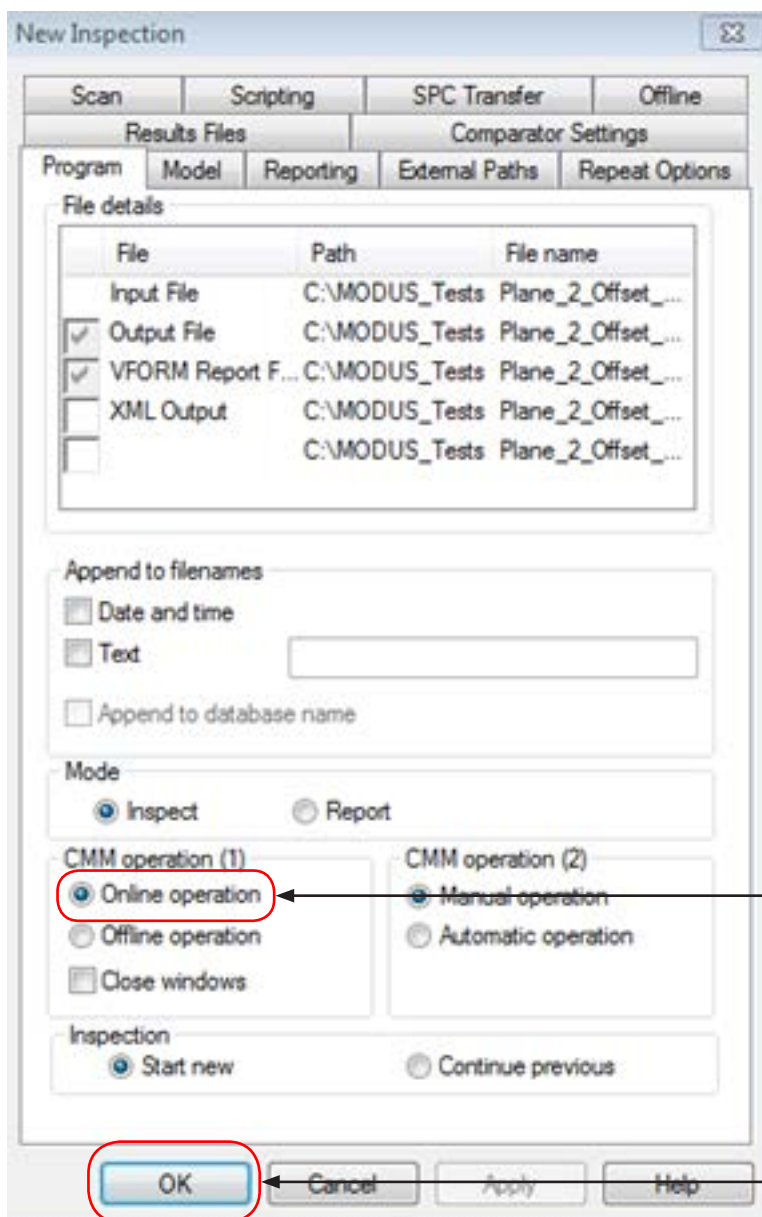


After clicking 'Browse' select a suitable location for the program:






Click: 'OK' to continue.



Ensure that 'Online operation' is selected in the 'Program' tab.

Click: 'OK' to continue.

The following header will be inserted into the program:



```

000001 DMISHN/'Start Template',05.2
000002 FILNAM/'Start Template',05.2
000003 DV(0)=DMESWU/'13,1,2,212'
000004 UNITS/MM,ANGDEC
000005 DECPL/ALL,DEFAULT
000006 V(0)=VFORM/ALL,PLOT
000007 DISPLY/TERM,V(0),STOR,DMIS,V(0)
000008 SNSET/APPRCH,5
000009 SNSET/CLSRF,15
000010 SNSET/DEPTH,0
000011 D(0)=DATSET/MCS
000012 MODE/MAN
000013 T(CORTOL_X1)=TOL/CORTOL,XAXIS,-0.1,0.1
000014 T(CORTOL_Y1)=TOL/CORTOL,YAXIS,-0.1,0.1
000015 T(CORTOL_Z1)=TOL/CORTOL,ZAXIS,-0.1,0.1
000016 T(DIAM_1)=TOL/DIAM,-0.1,0.1
000017 PAUSE
000018 ENDFIL

```


Insert some line spaces to make the program easier to read. Press

ctrl

I



Enter a space here and then press return.



```

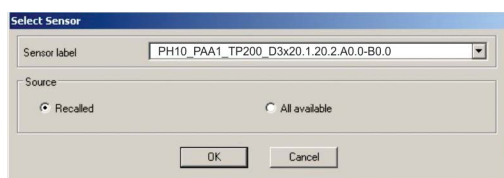
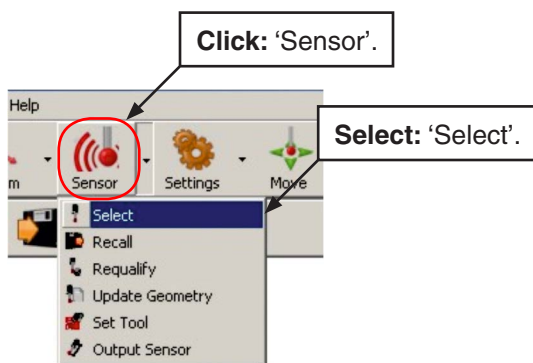
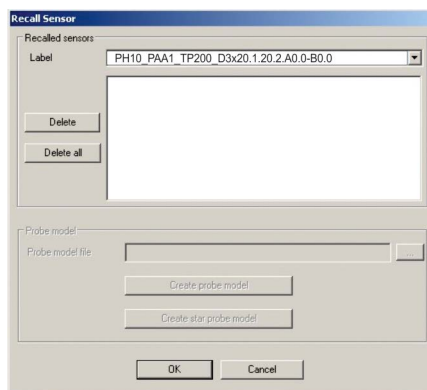
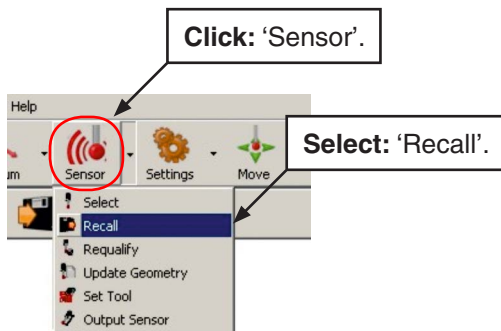
000003 DV(0)=DMESWU/'13,1,2,212'
000004 UNITS/MM,ANGDEC
000005 DECPL/ALL,DEFAULT
000006 V(0)=VFORM/ALL,PLOT
000007 DISPLY/TERM,V(0),STOR,DMIS,V(0)
000008 SNSET/APPRCH,5
000009 SNSET/CLSRF,15
000010 SNSET/DEPTH,0
000011 D(0)=DATSET/MCS
000012 MODE/MAN
000013 T(CORTOL_X1)=TOL/CORTOL,XAXIS,-0.1,0.1
000014 T(CORTOL_Y1)=TOL/CORTOL,YAXIS,-0.1,0.1
000015 T(CORTOL_Z1)=TOL/CORTOL,ZAXIS,-0.1,0.1
000016 T(DIAM_1)=TOL/DIAM,-0.1,0.1
000017 
000018 
000019 
000020 
000021 
000022 PAUSE
000023 ENDFIL

```

Place the cursor after the header code.

The sensor that is to be used needs to be recalled and selected.

Recall the tool by clicking 'Sensor' then selecting 'Recall':

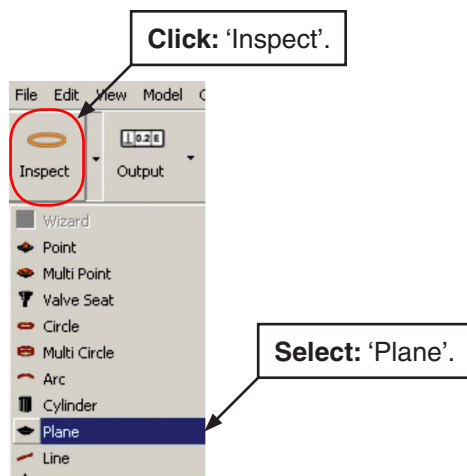


```

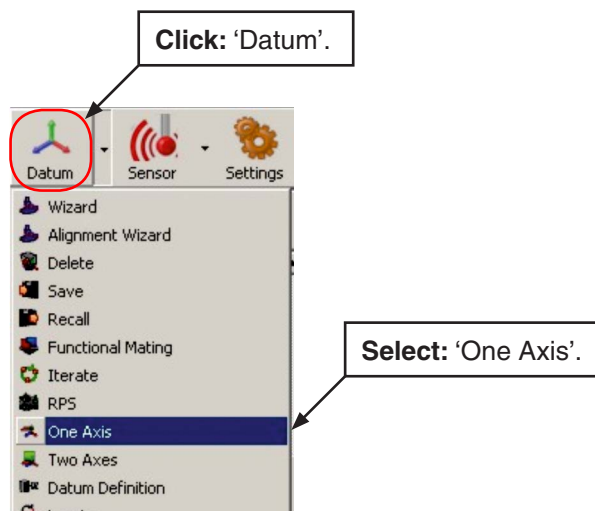
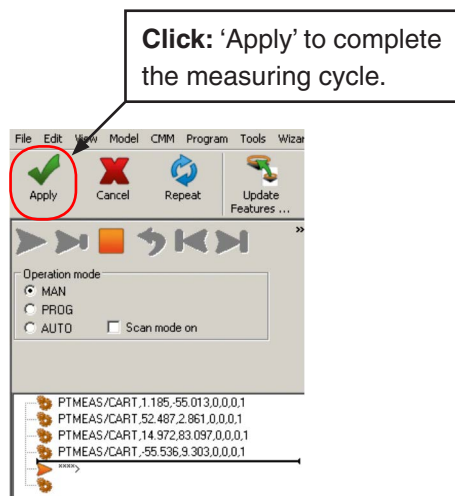
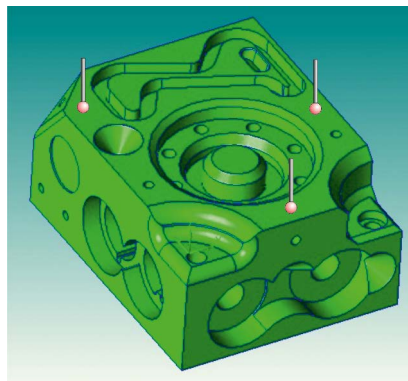
000012  MODE/MAN
000013  T(CORTOL_X1)=TOL/CORTOL,XAXIS,-0.1,0.1
000014  T(CORTOL_Y1)=TOL/CORTOL,YAXIS,-0.1,0.1
000015  T(CORTOL_Z1)=TOL/CORTOL,ZAXIS,-0.1,0.1
000016  T(DIAM_1)=TOL/DIAM,-0.1,0.1
000017
000018  RECALL/SA(PH10_PAA1_TP200_D3x20.120.2.A0.0-B0.0)
000019  SNSLCT/SA(PH10_PAA1_TP200_D3x20.120.2.A0.0-B0.0)
000020  ▶
000021
000022
000023  PAUSE
000024  ENDFIL
  
```

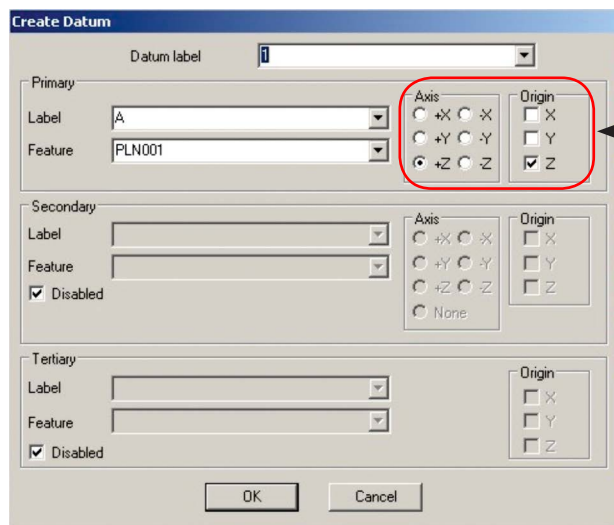
The program will now have two additional lines which recall and select the tool.

4 Measure a plane and two circles



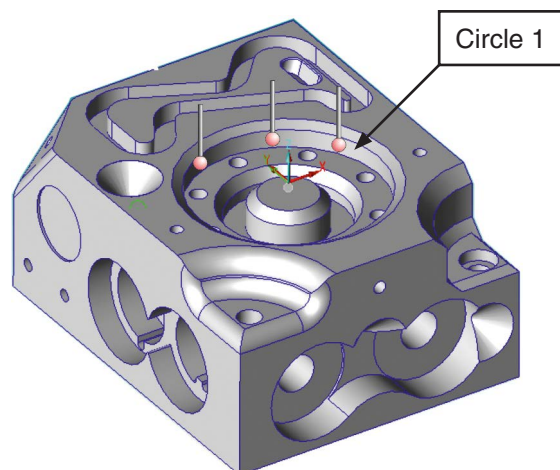
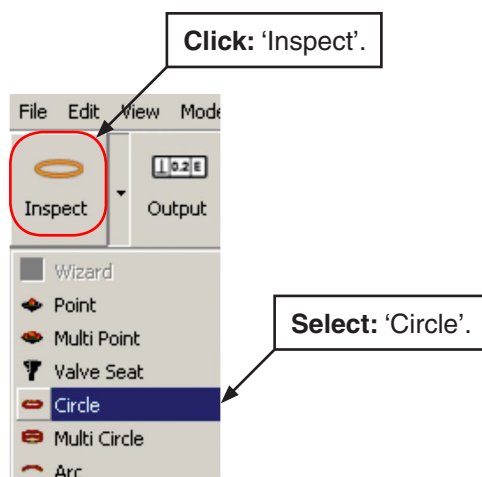
Take a minimum of three points on the plane:





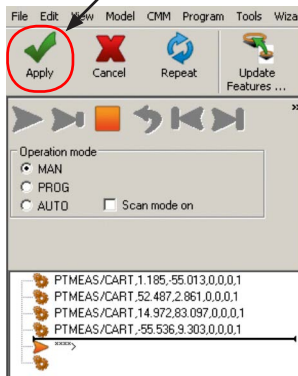
In this case the primary axis is normal to the measured plane and is in Z.

An origin on Z can also be set at this point.

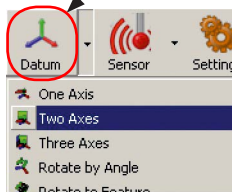


Take a minimum of three points in circle 1

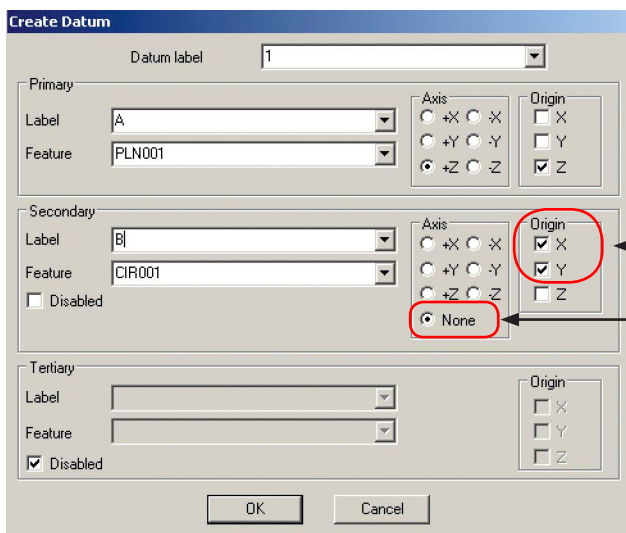
Click: 'Apply' to complete the measuring cycle.



Click: 'Datum'.

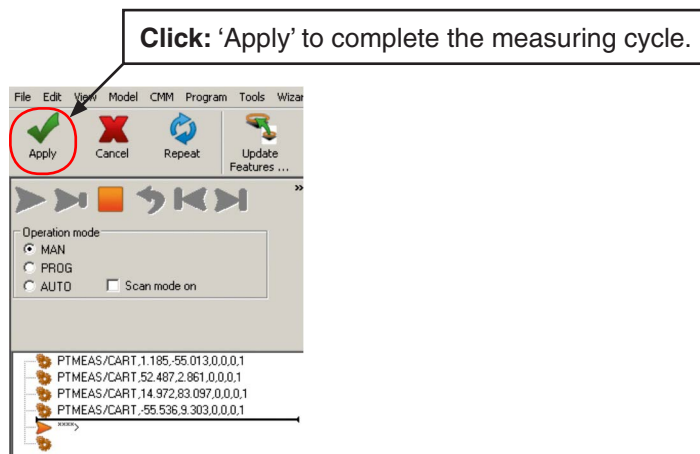
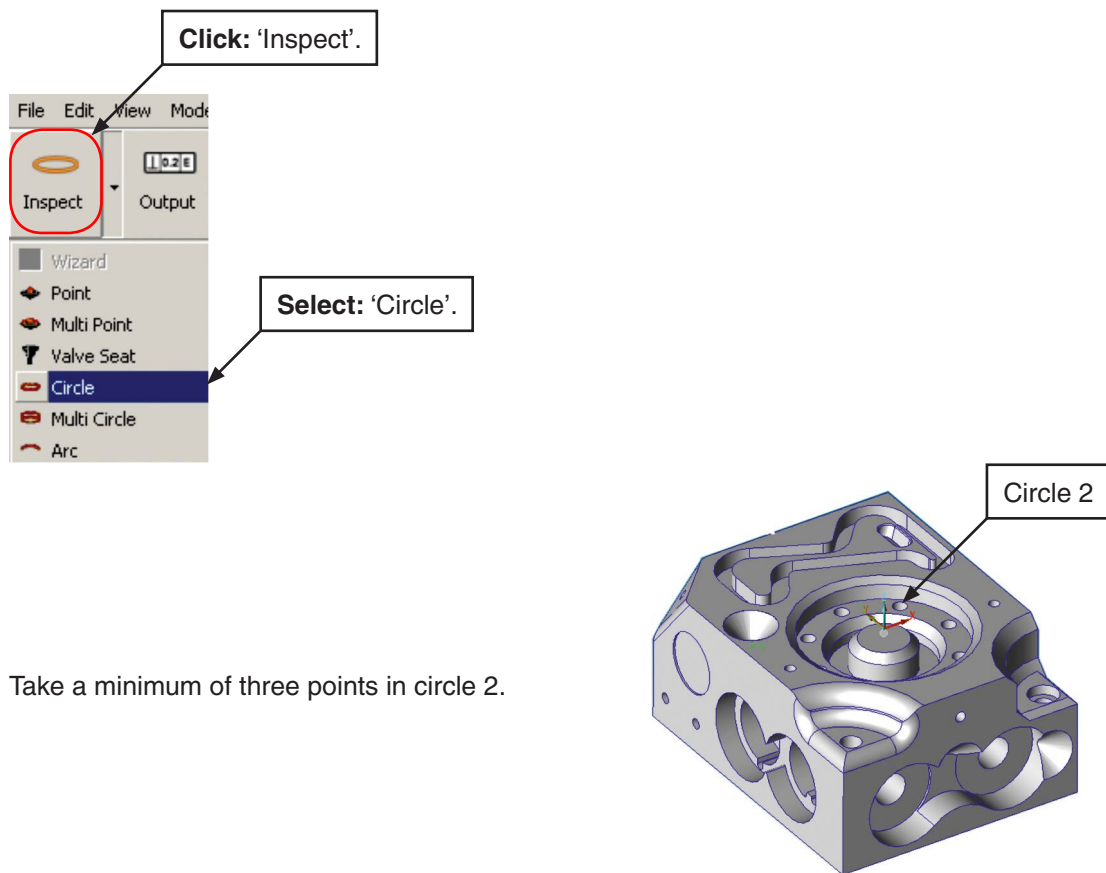


Select: 'Two Axes'.

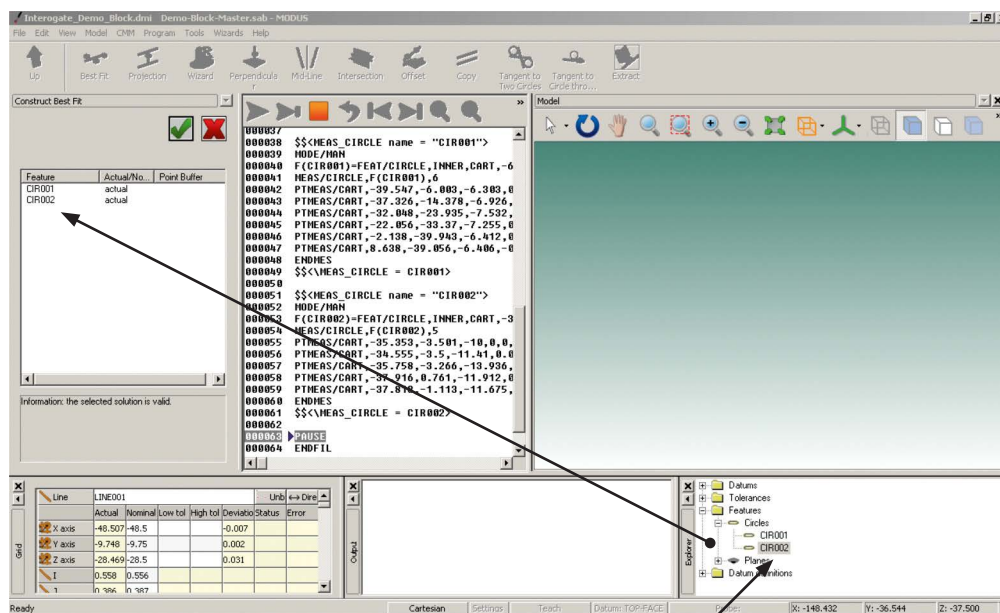
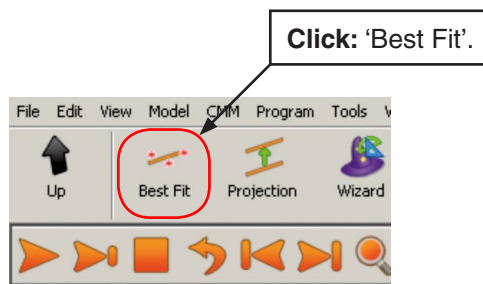
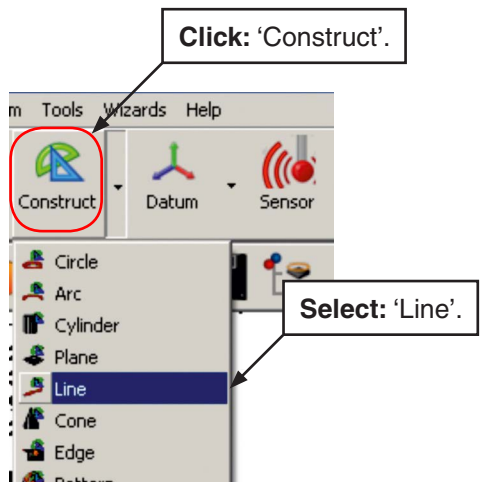


Set a datum on X and Y in CIR001.

Select 'NONE' as the second axis is not yet being set.



5 Construct a line from measured data

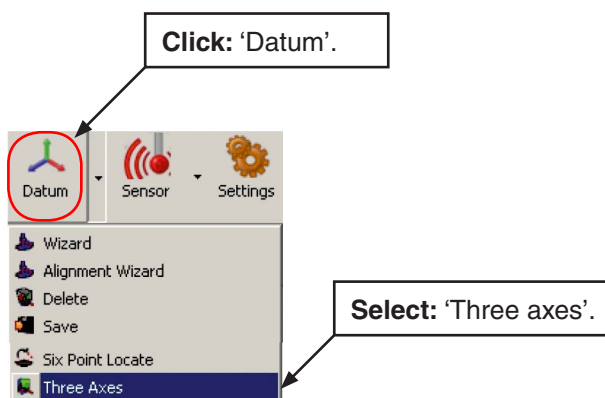
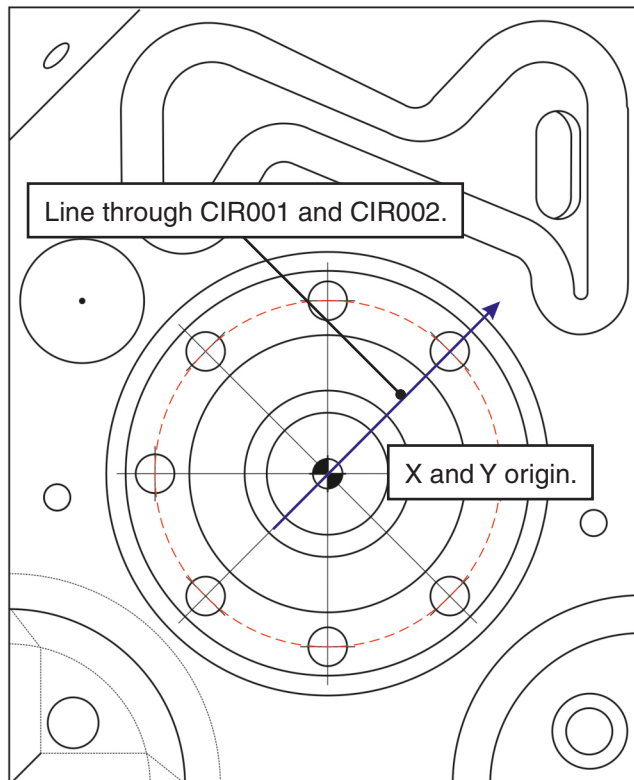


Double click on features CIR001 and CIR002
or
Drag and drop features into the construction area.

Click: 'Apply' to complete the construction cycle.

Code Produced :-

```
F(LINE001)=FEAT/LINE,UNBND,CART,57.5,20.13,-40,0,-1,0,-1,0,0  
CONST/LINE,F(LINE001),BF,FA(CIR001),FA(CIR002)
```



In this case PLN001 is the
PRIMARY AXIS [+Z]

LINE001 is the
SECONDARY AXIS [+X]
(no origin here)

CIR001 is the TERTIARY
point origin [X and Y]

The 'Create Datum' dialog box is shown with the following settings:

- Datum label:** 2
- Primary:** Label A, Feature PLN001, Axis +Z, Origin Z (checked).
- Secondary:** Label B, Feature LINE001, Axis +X, Origin X (checked).
- Tertiary:** Label C, Feature CIR001, Axis (None), Origin X (checked), Y (checked), Z (unchecked).

Buttons: OK, Cancel

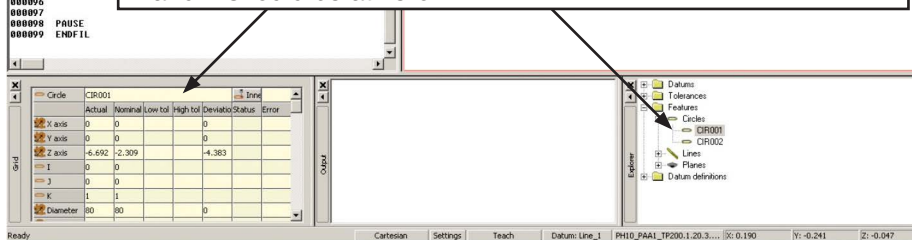
In this case the
constructed line lies
along the X axis.

NOTE: There is also the
option of selecting -X or
+Y/-Y.

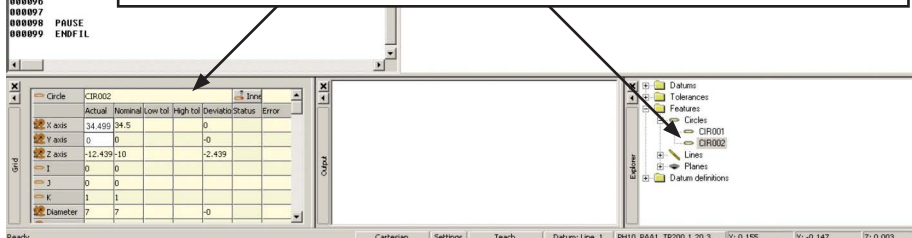
Click: 'OK' to complete the procedure

Now check if both circles are in the correct positions:

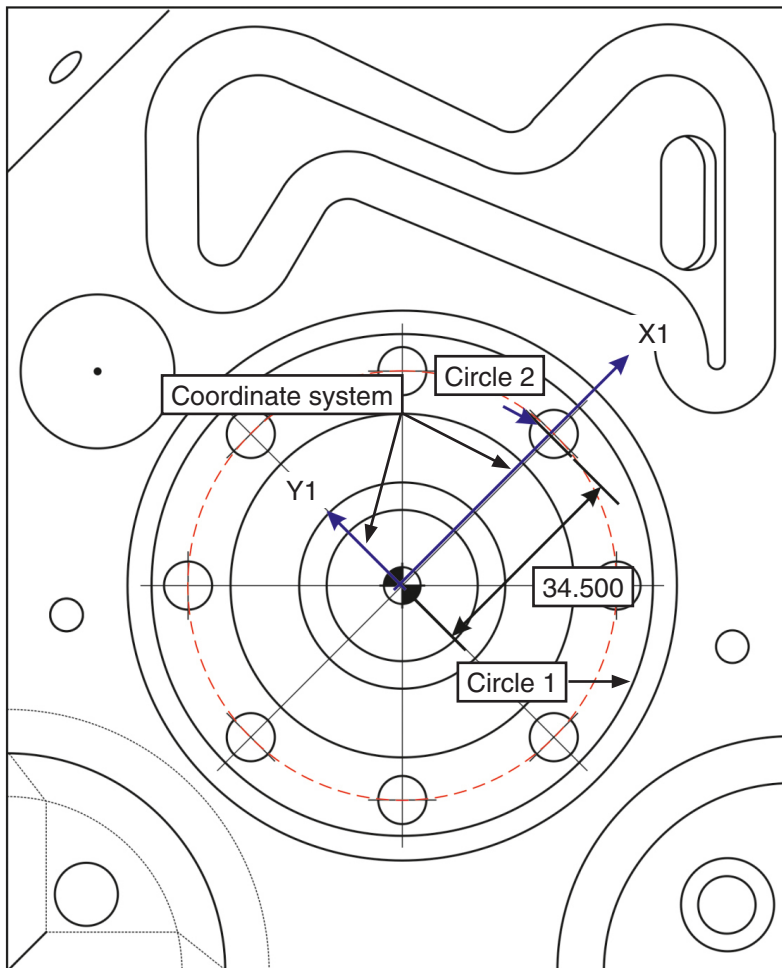
Left mouse click on CIR001. The grid will display the result. Both
X and Y should be at zero.



Left mouse click on CIR002. The grid will display the result:
X = 34.50 : Radial Distance From CIR001
Y = 0.00



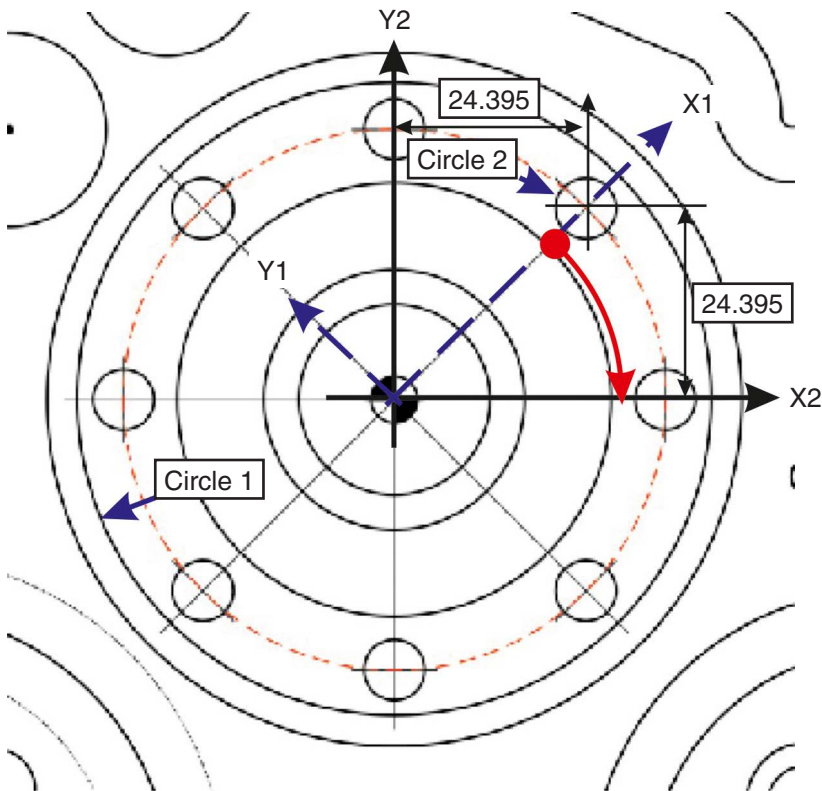
6 Rotate co-ordinate system by angle



Now make a theoretical rotation using the defined angle through the two co-ordinates given i.e:-

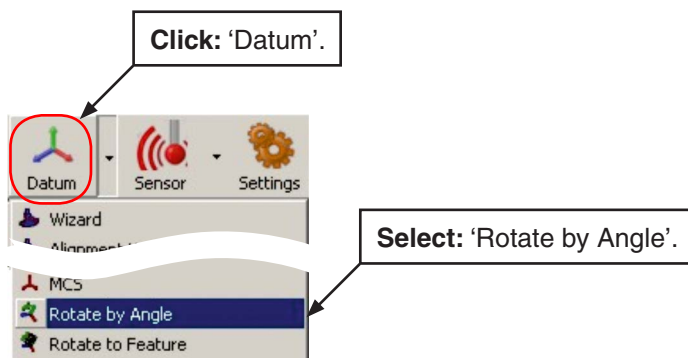
$X = 24.395$ and $Y = 24.395$

$\text{Angle} = \text{Inv Tan} (24.395 / 24.395) = 45^\circ$

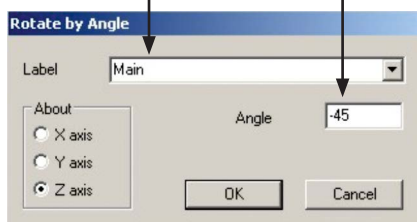


In this case the X and Y axes are to be rotated clockwise by 45°.

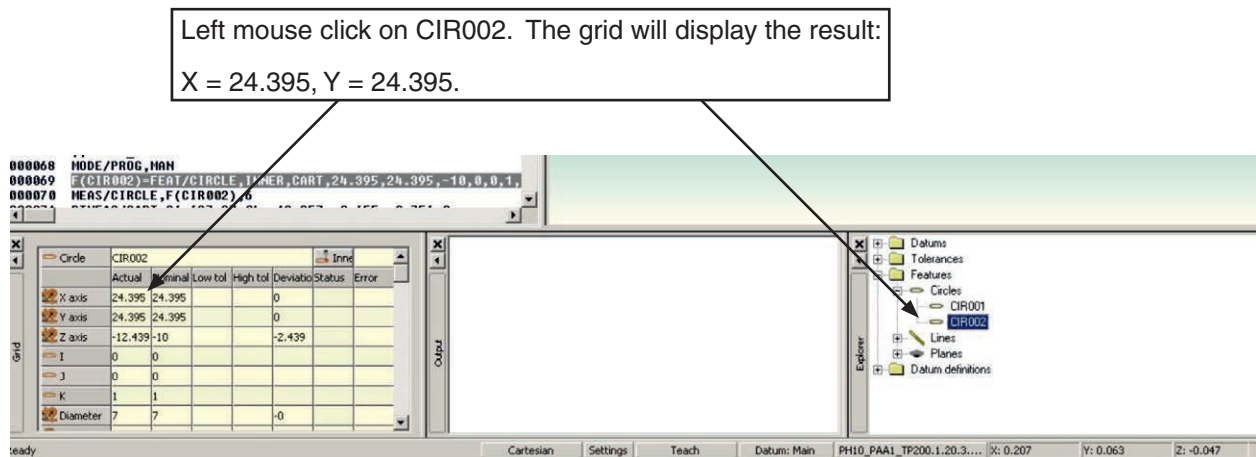
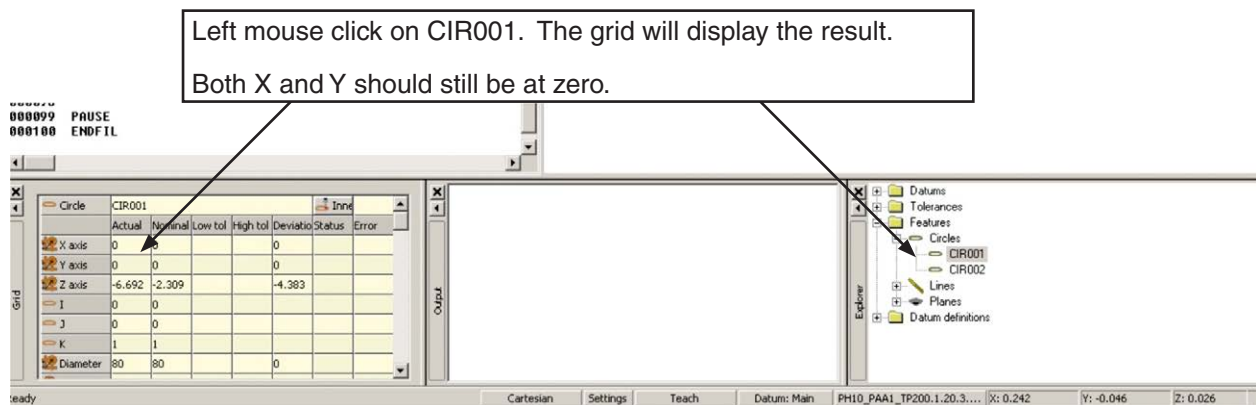
NOTE: -ve angles give clockwise rotation, +ve angles give anti-clockwise rotation.



Enter a label for the final alignment and enter the required angle of rotation.

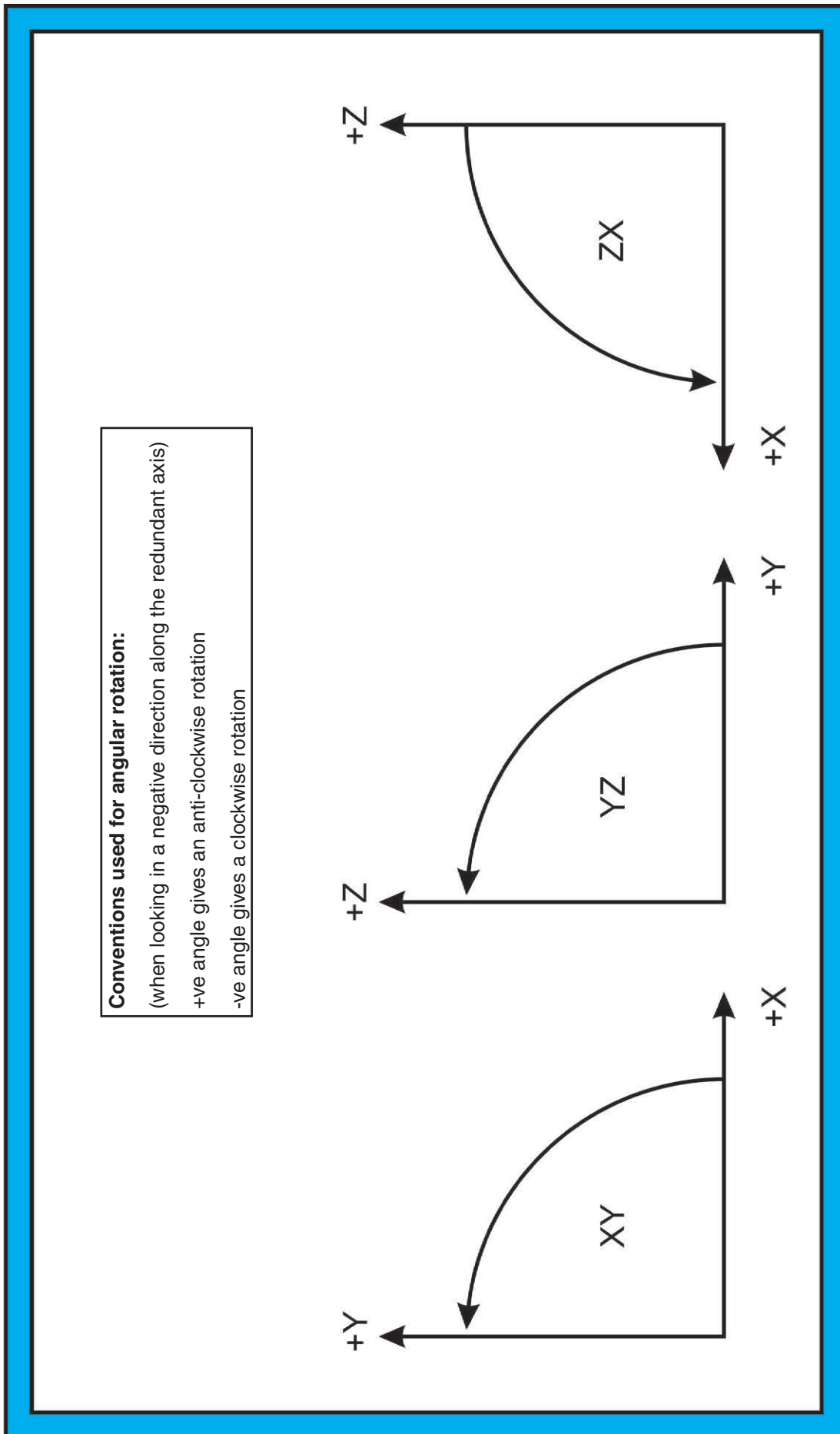


Now check if both circles are in the correct positions:



The part alignment is now complete and is ready for measurement.

GUIDANCE NOTE: This is a very basic manual alignment using reduced points and is not accurate enough for good metrology.



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